

NASA Space Science

An Overview

Presented to

41st GSFC Memorial Symposium

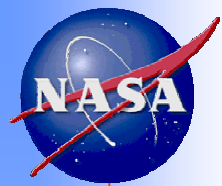
By

Mr. Chris Scolese

Deputy Associate Administrator

NASA Space Science

March 2003



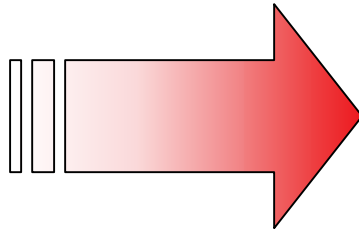
Space Science Enterprise Agency Vision and Mission

The NASA Vision: “To improve life here, to extend life to there, to find life beyond.”

The NASA Mission: “To understand and protect our home planet, to explore the universe and search for life, to inspire the next generation of explorers . . . as only NASA can.”

Space Science Vision

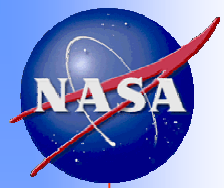
- How did the universe begin and evolve?
- How did we get here?
- Where are we going?
- Are we alone?



Space Science Themes

- Astronomical Search for Origins
- Structure and Evolution of the Universe
- Solar System Exploration
- Mars Exploration
- Sun Earth Connection

The Space Science Vision fully supports the NASA Mission



Sun-Earth Connection

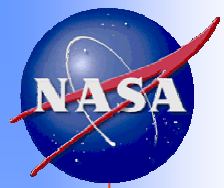
What causes solar variability?

How does solar variability affect the Earth and other planets?

How does solar variability affect life and society?

How does the Sun interact with the Interstellar Medium?





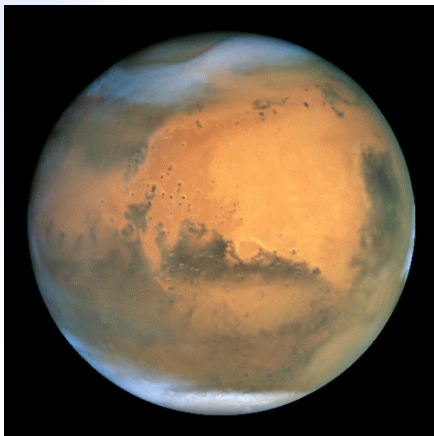
The Solar System Exploration Program

... seeks answers to fundamental questions about the solar system and life:

How do planets form?



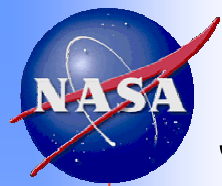
Why are planets different from one another?



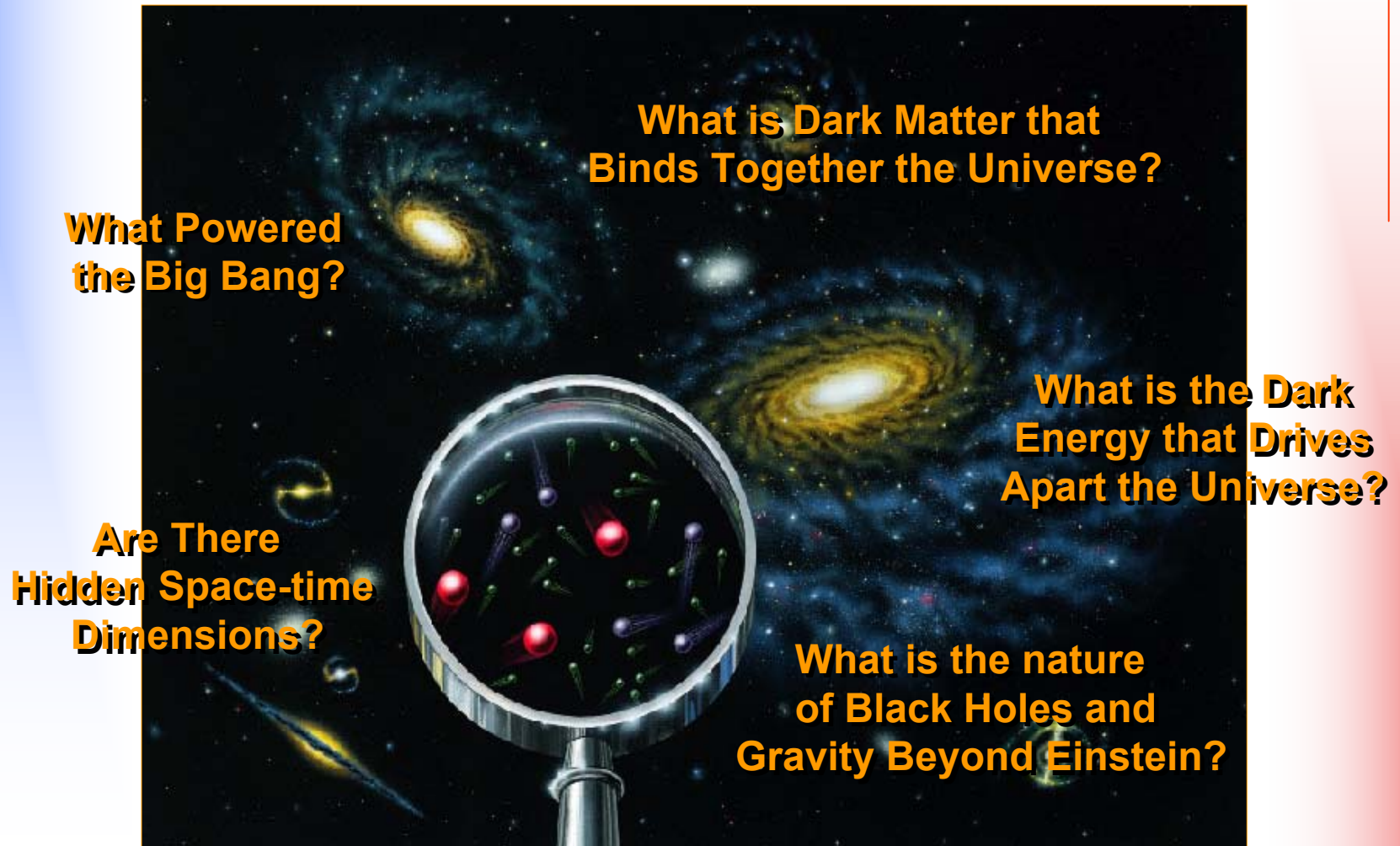
Where did the makings of life come from?

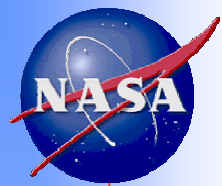
Did life arise elsewhere in the Solar System?

What is the future habitability of Earth and other planets?



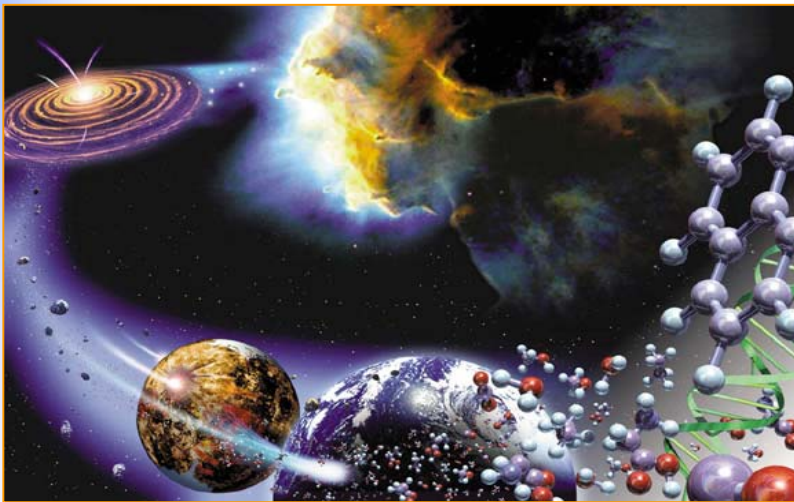
Structure and Evolution of the Universe





Astronomical Search for Origins

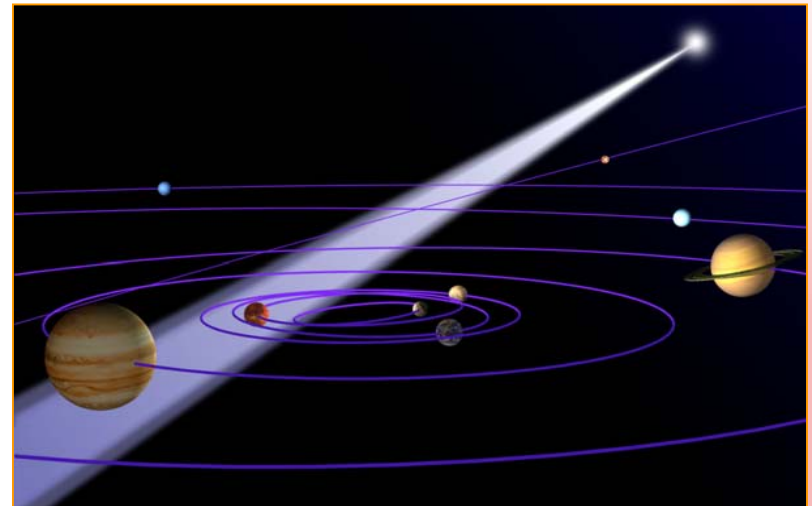
Where Did We Come From?



Tracing Our Cosmic Roots

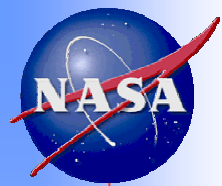
- Formation of galaxies, stars, heavy elements, planetary systems and life on the early Earth

Are We Alone?

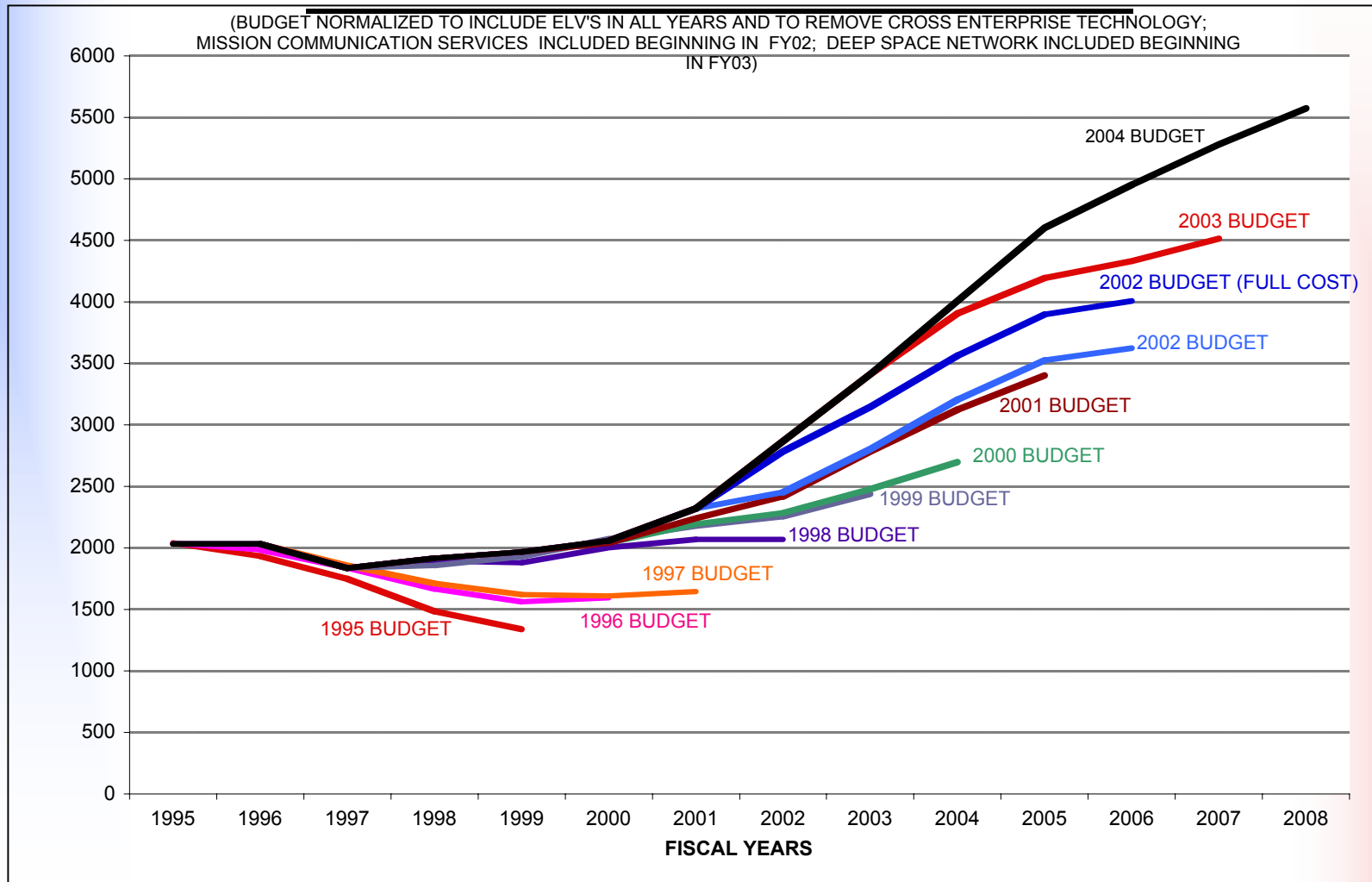


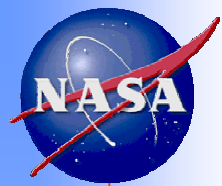
Search for Life Outside the Solar System

- Remote detection of biological activities on planets beyond our solar system

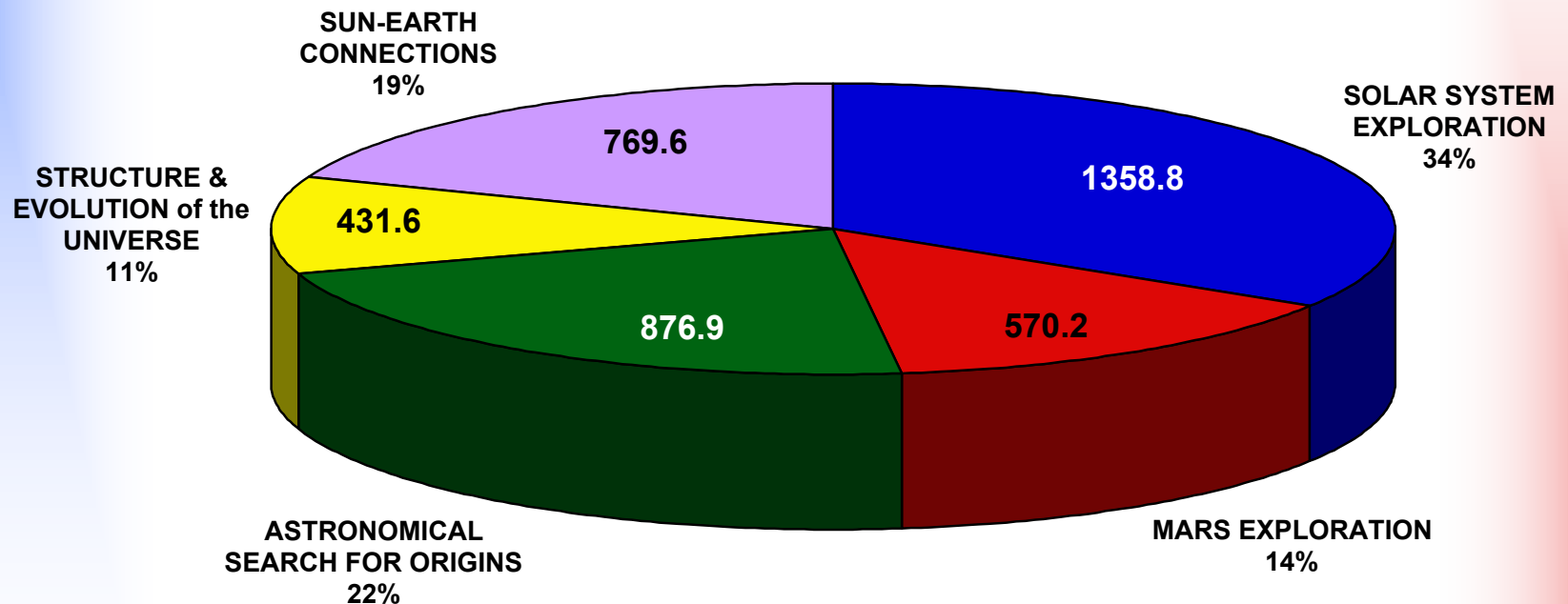


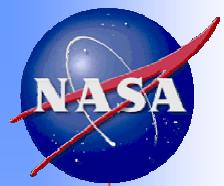
OSS Budget History





Full-Cost FY04 President's Budget

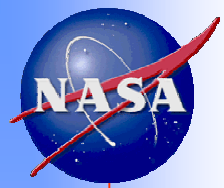




FY 2004 New Content

- Incorporates the existing NSI program and the new Jupiter Icy Moons Orbiter (JIMO) mission into a new initiative called Project Prometheus.
- Establishes an Optical Communications program, which enables revolutionary new data communications/transmission.
- Provides development funding for three key elements of the Beyond Einstein program: Constellation X, LISA and Einstein Probes.

Supports increased activity in priority programs



Project Prometheus

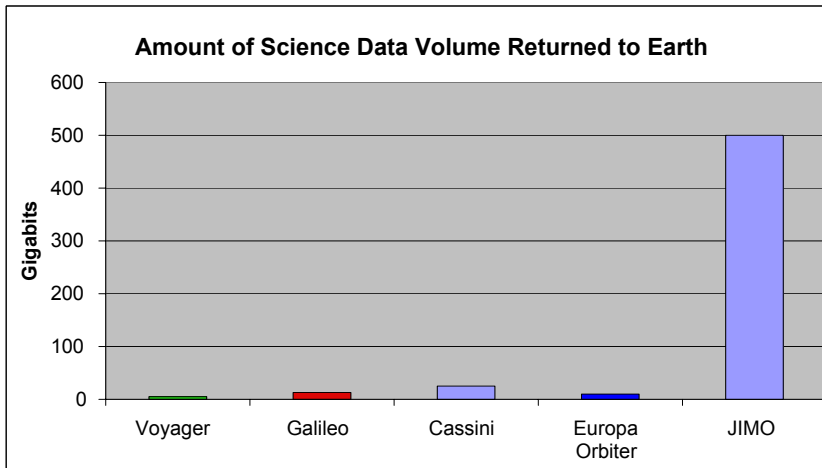
- Project Prometheus will enable vastly more robust and ambitious scientific missions by utilizing future spacecraft nuclear power capabilities.
- Nuclear power will:
 - Support more complex scientific instruments
 - Enable significantly larger and faster data communications networks
 - Allow a single spacecraft to visit multiple targets per mission
 - Eliminate dependence on gravity assists
- Project Prometheus includes:
 - The Nuclear Systems Initiative announced with the President's FY03 budget request
 - The Jupiter Icy Moons Orbiter (JIMO) mission, which is the first application of these technologies assigned to a flight mission.



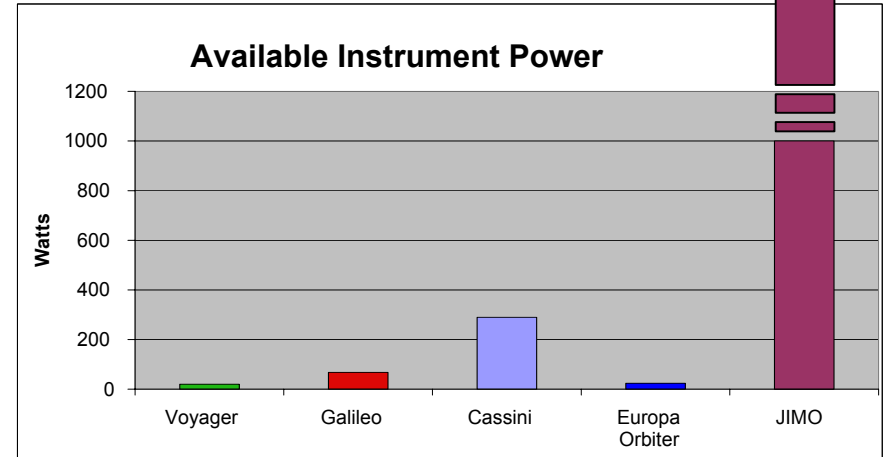
PROJECT PROMETHEUS

Revolutionary Capabilities

Amount of **power** available
to science instruments
*One bedside reading lamp
compared to a stadium light*

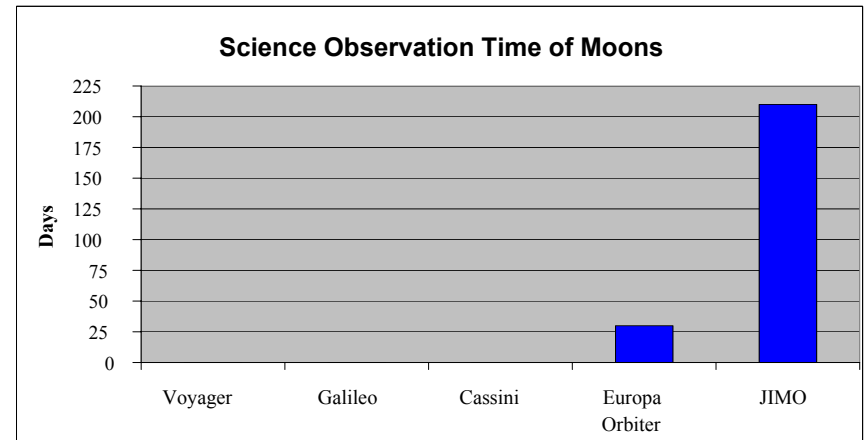


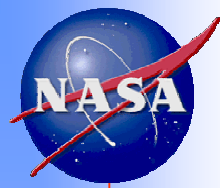
Time available for science
observation of moons
1 to 5 hours compared to 180 days



**Greater than
10,000 Watts!!**

Amount of science **data** return
1 – 2 floppy disks as compared to 120 CD-ROMs



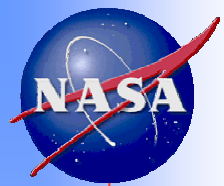


Project Prometheus: Jupiter Icy Moons Orbiter (JIMO)

- This mission responds to the National Academy of Sciences' recommendation that a Europa orbiter mission be the number one priority for a flagship mission in Solar System exploration.
- JIMO will search for evidence of global subsurface oceans on Jupiter's three icy moons: Europa, Ganymede, and Callisto.
- JIMO will be the first flight mission to use nuclear power and propulsion technologies.
- This mission will set the stage for the next phase of exploring Jupiter and will open the rest of the outer Solar System to detailed exploration.

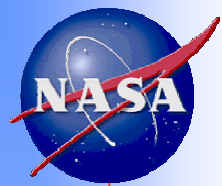


Artist's concept



Optical Communications

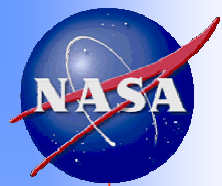
- Optical communications offers the potential for many orders of magnitude of improvement in communication data rate.
- Will allow for the return of the much greater quantities of scientific data.
 - Enabled by nuclear missions such as Project Prometheus (tours of multiple targets; extended orbital and surface stay times; high-power science instruments).
- Use of optical/laser communication technology will lower the cost per byte of data returned).



Example of Optical Communications

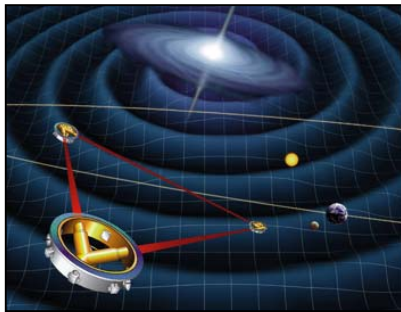
- The high-resolution camera on MRO will image $< 0.1\%$ of the planet after 1 Mars year due to limitations of the communication link back to Earth: ~ 2.2 Mbps at closest range and 0.3 Mbps at max range (2.7 AU).
- Were it available, optical communication would have the potential to increase the MRO communications link back to Earth to ~ 10 Mbps at closest range and 1 Mbps at maximum range. This improved high data rate allows one order of magnitude improvement in the time required to complete global high-resolution imaging of Mars. A 6 M pixel image of the entire surface of Mars could be achieved in 4 months!
- Data return from outer planets has the potential to be improved by an order of magnitude or better.



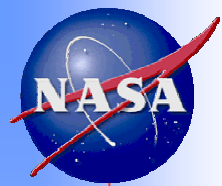


Beyond Einstein

- Significant expansion of efforts in NASA's Structure and Evolution of the Universe (SEU) theme, addressing its highest priorities as determined by the National Academy of Sciences' Decadal Survey.
- Funding for full development of two major missions: LISA and Constellation-X.



- Funding to initiate "Einstein Probes," a program that will begin later this decade.
 - this program consists of fully and openly competed missions (in the manner of the Discovery, Explorers, and New Frontiers programs) to conduct investigations that benefit the Beyond Einstein science objectives.



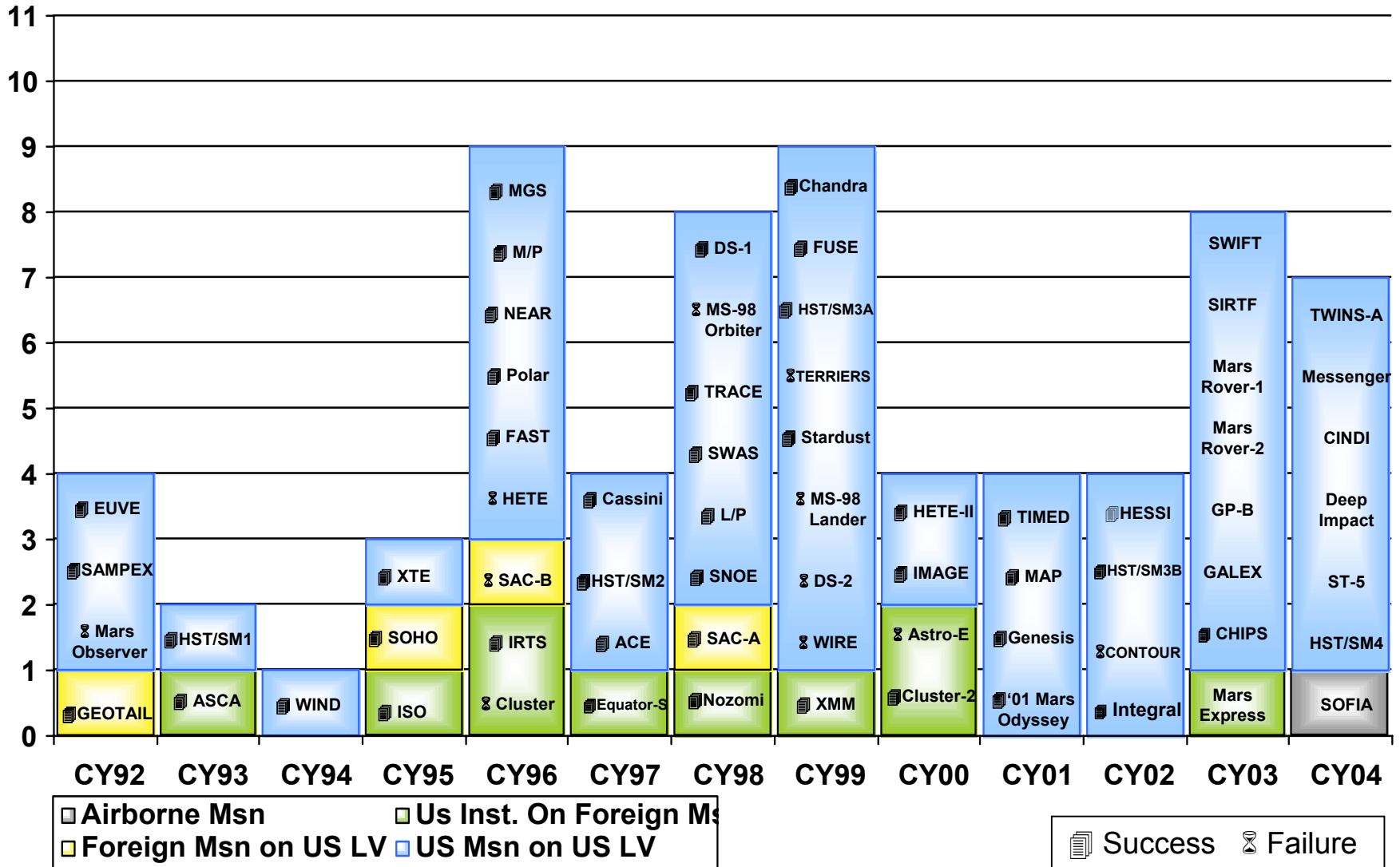
2003 Space Science Launches

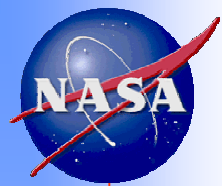
- CHIPSat - Launched from VAFB January 12
- SIRTf - Scheduled from CCAFS April 18
- GALEX - Scheduled from CCAFS April 26
- Mars Exploration Rover A - Scheduled from CCAFS May 30
- Mars Exploration Rover B - Scheduled from CCAFS June 25
- Gravity Probe B - Scheduled from VAFB NET November 20*
- SWIFT - Scheduled from CCAFS December 5
- CINDI - Scheduled from KWAJ January 23, 2004

*currently under review



Major NASA Space Science Launches (CY93-CY04)





Upcoming Launch: SIRTf

Launch:

April 18, 2003 from Cape Canaveral, FL.

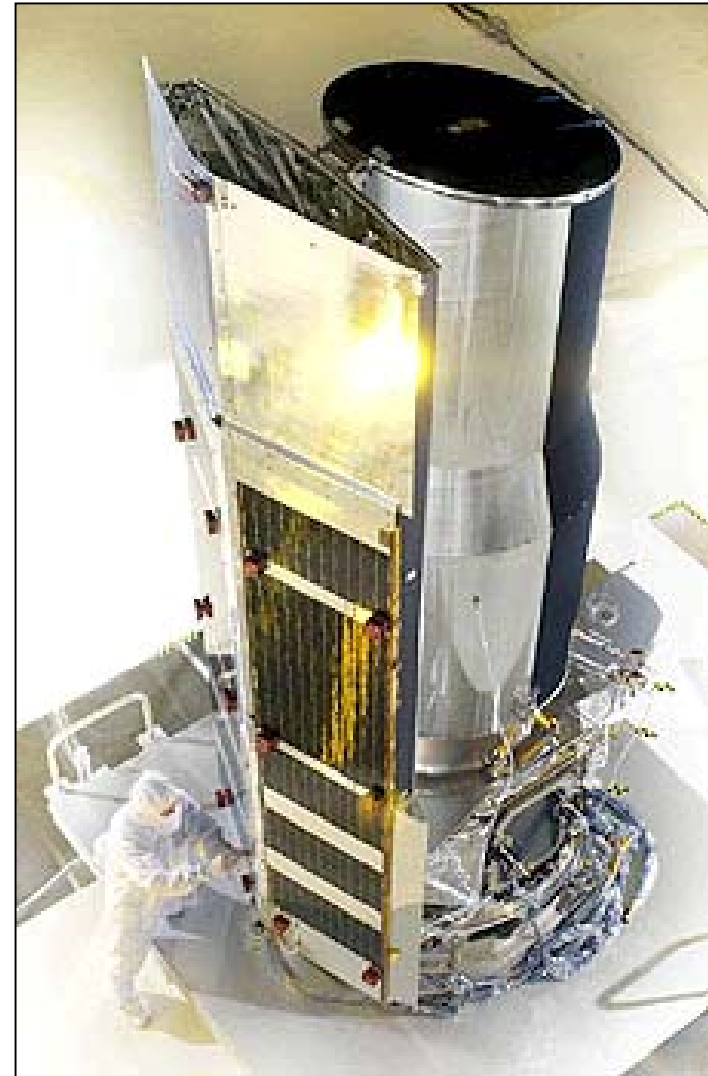
Launch Vehicle:

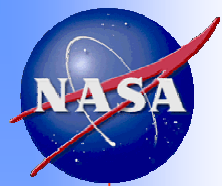
Delta II Heavy

Primary Science Objective:

SIRTf will obtain images and spectra by detecting the infrared energy, or heat, radiated by objects in space.

Most infrared radiation is blocked by the Earth's atmosphere and cannot be observed from the ground.





Upcoming Launches: GALEX

Launch:

April 26, 2003 from Cape
Canaveral, FL.

Launch Vehicle:

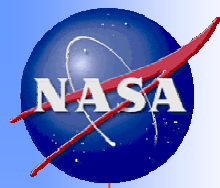
Pegasus

Primary Science Objective: The
Galaxy Evolution Explorer (GALEX)
will observe galaxies in ultraviolet
light across 10 billion years of cosmic
history.

Such observations will tell scientists
how galaxies evolve and change.

GALEX will probe the causes of star
formation during a period when most
of the stars and elements we see
today had their origins.





Upcoming Launches: Mars Exploration Rovers

Launches:

May 30 and June 25, 2003 from
Cape
Canaveral, FL.

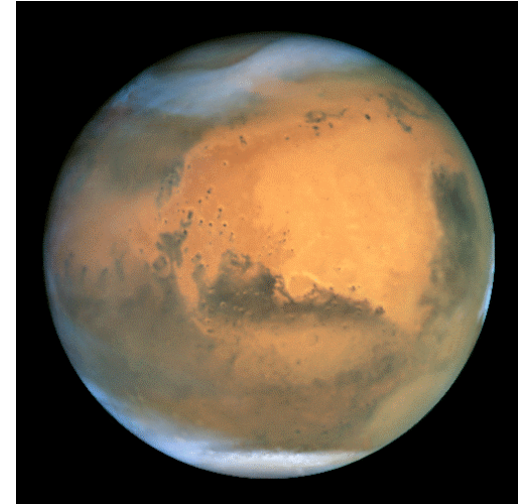
Launch vehicles:

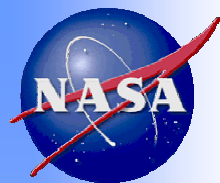
Delta IIs.

Primary Science Objective:

Looking for Signs of Past
Water on Mars.

The big science question for
the Mars Exploration Rovers
is how past water activity on
Mars has influenced the red
planet's environment over time.

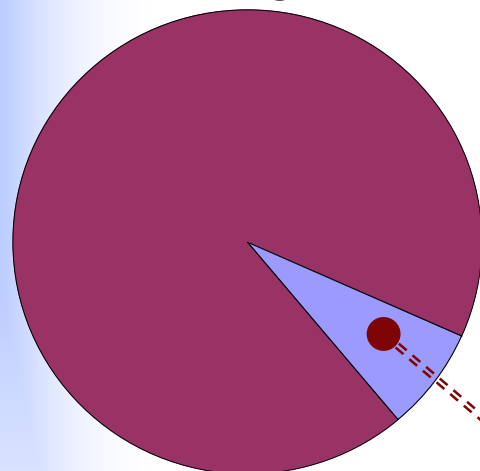




2002 Science News Metrics

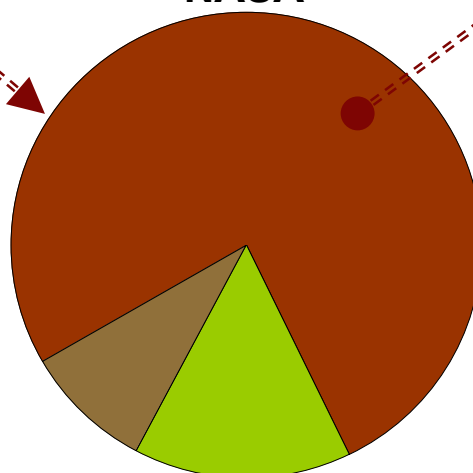
Contributions to World Discoveries and Technological Achievements

THE WORLD



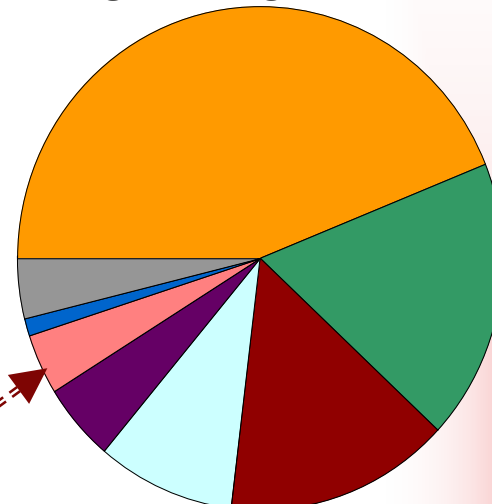
- Rest of the World (92.8%)
- NASA (7.2%) (OF THIS)

NASA



- Space Science (76%) (OF THIS)
- Earth Science (15%)
- Space Flight (9%)

SPACE SCIENCE



- HST (44%)
- Chandra (18%)
- Astrobiology (15%)
- FUSE (9%)
- CGRO (5%)
- MGS (4%)
- Rocket/Balloon (1%)
- Other (4%)*

* Includes Includes Nstars (2.6%), IRAS (0.5%), and SIM related research (0.9%)

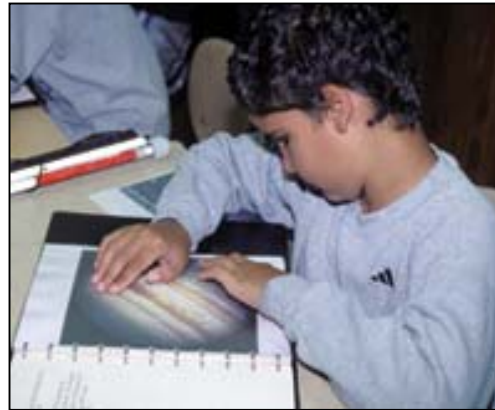


Education and Public Outreach: Getting Results



Voyage: A Scale Model Solar System on the National Capitol Mall

Share the excitement with the public . . .



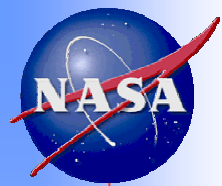
Enhance the quality of education . . .

A Braille book of astronomy

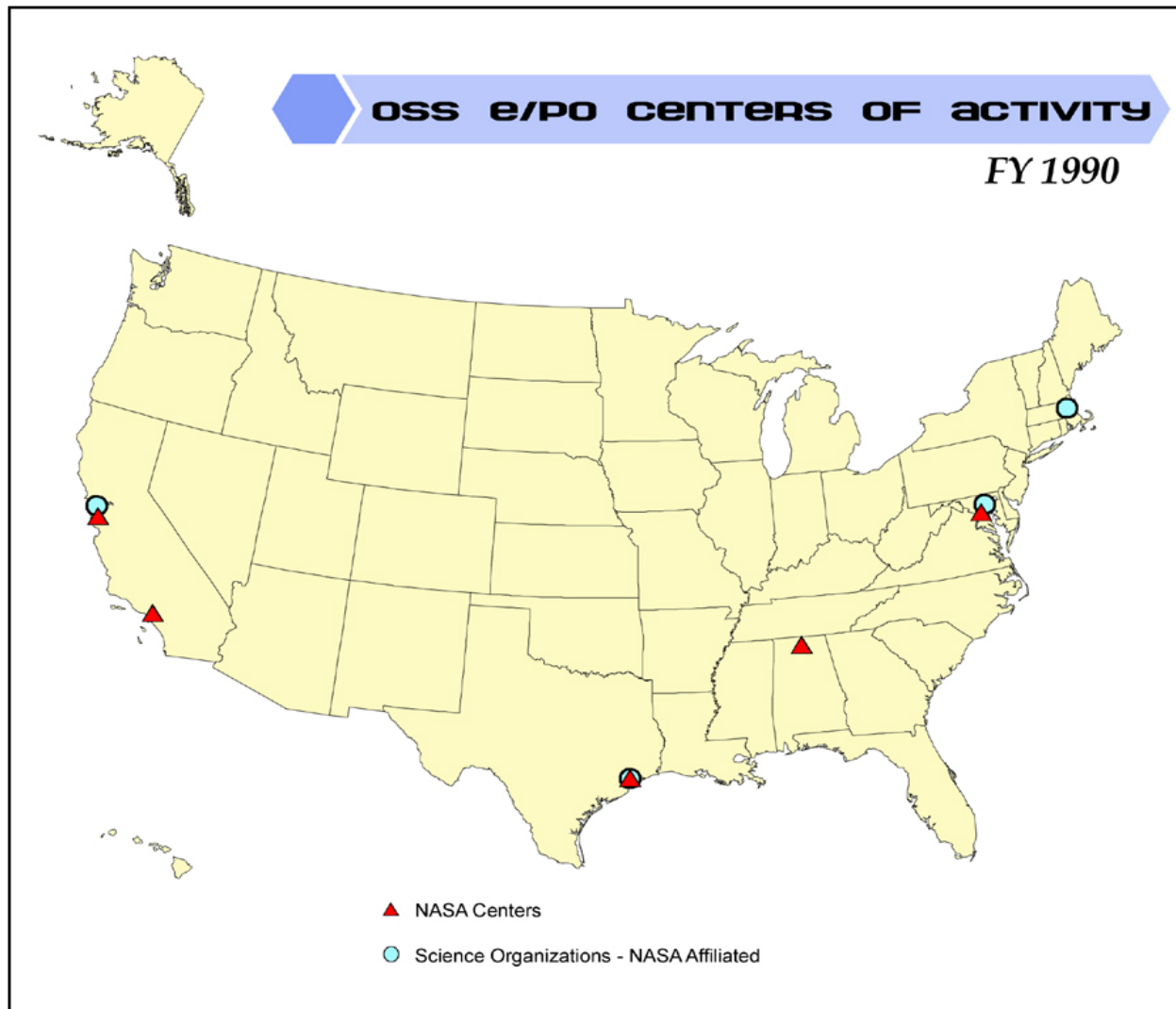
. . . Help create the 21st century workforce.

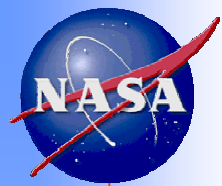
Space Science Bachelor's Degree Program at CUNY





OSS E/PO Program: Where We Were . . .





Extent of FY 2002 OSS E/PO Program

- 330 E/PO activities and 70 new products
- More than 3,600 discrete E/PO events
- Presence in all 50 states, DC, and PR
- Presence at 22 national and 30 regional E/PO conferences
- More than 30 awards and other forms of public recognition received

Estimated participants:

- Over 350,000 direct participants in workshops, community/school visits, and other interactive special events.
- Over 1.7 million visitors for museum exhibitions, planetarium shows, public lectures, and special events.
- Over 7 million Internet participants for web casts, web chats, and other web events.
- Accessible to 200 million through conference exhibits, radio and television broadcasts, newspaper columns, and other forms of public media.

